

CLAIMS

1. A multi-frequency antenna duplexer comprising:  
a package, and  
a plurality of antenna duplexers, mounted in said package, having  
5 different passing bands from each other,

wherein each of said plurality of antenna duplexers includes a transmitter surface acoustic wave (SAW) filter and a receiver SAW filter having a passing band different from the passing band of the transmitter SAW filter.

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2. The multi-frequency antenna duplexer of claim 1,  
wherein the transmitter SAW filter of said each of the plurality of antenna duplexers is formed on a first piezoelectric substrate,  
the receiver SAW filter of said each of the plurality of antenna  
15 duplexers is formed on a second piezoelectric substrate, and  
in each of the receiver SAW filters, a phase shift substrate for rotating  
a phase of a transmission band of said multi-frequency antenna duplexer  
including said each of the receiver SAW filters is incorporated in the package.

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3. The multi-frequency antenna duplexer of claim 1,  
wherein said each of the transmitter SAW filters and the receiver SAW  
filters of said multi-frequency antenna duplexer are formed on one  
piezoelectric substrate, and  
in said each of the receiver SAW filters, a phase shift substrate for  
25 rotating a phase of a transmission band of the antenna duplexer including  
said each of the receiver SAW filters is incorporated in the package.

4. The multi-frequency antenna duplexer of claim 1,  
wherein a phase shift substrate is formed in an inner layer of the  
package.

5. A multi-frequency antenna duplexer comprising:  
a package, and  
a plurality of antenna duplexers, mounted in said package, having  
passing different bands from each other,  
wherein each of said plurality of antenna duplexers includes a  
transmitter filter and a receiver filter having a passing band different from a  
passing band of the transmitter filter,  
at least one of the transmitter filter and the receiver filter is a bulk  
wave filter, and  
when one of the transmitter filter and the receiver filter is the bulk  
wave filter, another is a surface acoustic wave (SAW) filter.

6. The multi-frequency antenna duplexer of claim 5,  
wherein the receiver filter of any one of the plurality of antenna  
duplexers is the SAW filter, in the SAW filter, a phase shift substrate for  
rotating a phase of a transmission band of the antenna duplexer including the  
SAW filter is incorporated in the package.

7. The multi-frequency antenna duplexer of claim 6,  
wherein the phase shift substrate is formed in an inner layer of the  
package.

8. A multi-frequency antenna duplexer comprising:

a package,

two antenna duplexers, mounted in said package, having different passing bands each other, and

5 a branching filter for coupling antenna terminals of the two antenna duplexers and one antenna terminal included in the package,

wherein each of said two antenna duplexers includes a transmitter surface acoustic wave (SAW) filter and a receiver SAW filter having a passing band different from a passing band of the transmitter SAW filter.

10 9. The multi-frequency antenna duplexer of claim 8,

wherein each of the transmitter SAW filters of the two antenna duplexers is formed on a first piezoelectric substrate,

the receiver SAW filter of each of the two antenna duplexers is formed on a second piezoelectric substrate, and

15 in said each of the receiver SAW filters, a phase shift substrate for rotating a phase of a transmission band of the multi-frequency antenna duplexer including the receiver SAW filter is incorporated in the package.

10. The multi-frequency antenna duplexer of claim 8,

20 wherein the transmitter SAW filter and the receiver SAW filter of said each of the two antenna duplexers are formed on one piezoelectric substrate, and

25 in the receiver SAW filter, a phase shift substrate for rotating the phase of transmission band of the antenna duplexer including the receiver SAW filter is incorporated in the package.

11. The multi-frequency antenna duplexer of claim 8,

wherein the phase shift substrate and branching filter are formed in an inner layer of the package.

12. An multi-frequency antenna duplexer comprising:

5 a package,

two antenna duplexers, mounted in said package, having different passing bands each other, and

a branching filter for coupling antenna terminals of the two antenna duplexers and one antenna terminal included in the package,

10 wherein each of said two antenna duplexers includes a transmitter filter and a receiver filter having a passing band different from a passing band of the transmitter filter,

at least one of the transmitter filter and the receiver filter is a bulk wave filter, and

15 when one of the transmitter filter and the receiver filter is the bulk wave filter, another is a surface acoustic wave (SAW) filter.

13. The multi-frequency antenna duplexer of claim 12,

wherein the receiver filter is the SAW filter, in the SAW filter, a phase 20 shift substrate for rotating a phase of transmission band of the antenna duplexer including the SAW filter is incorporated in the package.

14. The multi-frequency antenna duplexer of claim 13,

wherein the phase shift substrate and branching filter are formed in 25 an inner layer of the package.